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ABSTRACT

This program evaluation report presents information on Project SKI*HI, a home-based program for infants and young children with hearing impairments and their families. The program's major goals are early identification of hearing-impaired infants and a home program to facilitate child development. A parent advisor makes weekly home visits to each family and works closely with both parents and other members of the multidisciplinary team to assess, plan, and provide appropriate home-based services for all family members. Evaluation results indicate: (1) SKI*HI children show higher rates of development during intervention than prior to intervention and greater gains in receptive and expressive language development than would be expected due to maturation alone; (2) SKI*HI children show increased auditory, communication-language, and vocabulary developmental levels and increased full-time hearing aid use; (3) SKI*HI parents show increased ability to manage their child's hearing handicap, communicate meaningfully with their child, and promote their child's cognitive development; and (4) SKI*HI children are identified at an early age and begin to receive home programming services promptly after identification. Appendixes provide detailed findings. Also included are project administrator responses to 17 questions concerning the report. Includes 40 references. (Author/DB)

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TITLE: PROJECT SKI*HI OUTREACH PROGRAMMING FOR HEARING IMPAIRED INFANTS AND FAMILIES: Recertification Statement, Questions, Responses, and Approval

AUTHORS: Dr. Carol J. Strong and Dr. Thomas C. Clark, SKI*HI Institute, Department of Communicative Disorders, Utah State University

DATE: June, 1990

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Evidence of Program Effectiveness

PROJECT SKI*HI OUTREACH

PROGRAMMING FOR HEARING IMPAIRED INFANTS AND FAMILIES

THROUGH

HOME INTERVENTION

(A Recertification Statement)

JDRP APPROVAL 78-192
JDRP RECERTIFICATION OCTOBER 17, 1984

Submitted to

U. S. Department of Education

Program Effectiveness Panel

Program Area
Special Education--Programming for
Handicapped Students

June, 1990

ABSTRACT

SKI*HI is a home-based program for infants and young children with hearing impairments and their families. The major goals of the program are to identify hearing impaired children as close to birth as possible and to provide them and their families with complete home programming that will facilitate development. The delivery model for the program includes identification/screening services, home-visit services, support services, and program management. The "heart" of the service is provided by a parent advisor who makes weekly home visits to families. The parent advisor works closely with parents and other members of a multi-disciplinary team to assess, plan, and provide appropriate home-based services for all family members.

The major accomplishments of SKI*HI are (a) SKI*HI children show higher rates of development during intervention than prior to intervention and greater gains in receptive and expressive language development than would be expected due to maturation alone. Also, they show pre- to posttest developmental gains that are statistically significant and that yield effect sizes that indicate important practical effects; (b) SKI*HI children show increased auditory, communication-language, and vocabulary developmental levels and increased full-time hearing aid use using SKI*HI programming; (c) SKI*HI parents show increased ability to manage their child's hearing handicap, communicate meaningfully with their child, and promote their child's cognitive development using SKI*HI programming; and (d) SKI*HI children are identified at an early age and begin to receive home programming services promptly after identification.

BASIC INFORMATION

Project Title: Programming for Hearing Impaired Infants and Families Through Home Intervention--Project SKI*HI Outreach

Location:
SKI*HI Institute
Department of Communicative Disorders
Utah State University
Logan, Utah 84322-1900

Contact Person: Dr. Thomas C. Clark (1-801-752-4601)

Original Developer Applicant Agency:
Utah School for the Deaf (Legal Status: State Agency)
846 20th Street
Ogden, Utah 84401

Years of Project:
Dates Developed: July 1, 1972 - June 30, 1975
Dates Operated: July 1, 1975 to Present
Dates Evaluated: July 1, 1974 - June 30, 1978
Initial JDRP Approval (Certification): 1978
Recertification: October 14, 1984
Dates Disseminated: July 1, 1975 to Present

Source(s) and Level(s) of Development and Dissemination Funding:

July 1, 1990 - June 30 1991

Federal:	NDN Developer Demonstrator Grant	$ 64,552
	OSEP-HCEEP Outreach	121,250
Other:	Agencies Receiving Adoption Services	75,000
	Total Dissemination:	$ 268,802

Note: Adoption agencies using the SKI*HI Model report $6,220,000 in local funds during the 1989-90 academic year to provide services to children and families.

DESCRIPTION OF PROGRAM

Goals: The major goals of the SKI*HI Program are to identify hearing impaired infants and young children as close to birth as possible and to provide them and their families with complete home programming that will facilitate their development. Specific goals for the child are that he or she will be able to (a) communicate meaningfully with significant persons in the home; (b) use residual hearing; (c) develop a communication method (i.e., aural-oral, total communication, or other); (d) develop optimal receptive and expressive language levels; and (e) be provided with maximum amplification. Specific goals for the parents are that they will (a) have a warm, positive relationship with the child; (b) provide a stimulating, interactive home environment; (c) be able to manage the child's hearing aids; (d) assist the child to use his or her residual hearing; and (e) provide communication-language stimulation.

Purposes and Needs Addressed: The SKI*HI Program is designed to ameliorate the profound negative effects of a hearing loss on a child's communication and language development. The language input a child receives during the early years of life is crucial to his or her acquisition of communicative/linguistic competence and later academic skills. If the child suffers an early language deprivation, there are profound negative effects on all areas of language development, including vocabulary, syntax, conversation, writing, speaking, and reading (Allen, 1986; Clark, 1988; Jensema, Karchmer, & Trybus, 1978; McAnnally, Rose, & Quigley, 1987; Oller, 1985; Quigley, 1978; Quigley & Paul, 1986). Language deprivation can affect other areas of development as well, such as socialization and cognitive performance (Meadow, 1980; Moores, 1987; Sanders, 1988). The child with a hearing impairment and the child's family need early, family-focused, cost-efficient intervention. The SKI*HI Model addresses this need by providing early identification and early home programming that promote the child's communicative, auditory, cognitive, and linguistic development by enhancing the understanding and skills of parents.

Intended Audience: Project SKI*HI is designed to be used with hearing impaired children, 0-5 years of age, and their families.

Background, Foundation, and Theoretical Framework: The SKI*HI Model was conceived and developed as a comprehensive model for the identification of and home intervention with hearing impaired children in Utah. Administered by the Utah School for the Deaf, SKI*HI was funded as a Demonstration Model by the U.S. Department of Education, Handicapped Children's Early Education Program (HCEEP) from 1972 to 1975. In 1975, SKI*HI received HCEEP Outreach funding. The SKI*HI Model was first validated by the Joint Dissemination Review Panel as an exemplary educational program in 1978 and was revalidated in 1984. The SKI*HI Model has been adopted by about 260 agencies in the United States, Canada, and Britain, and is used with more than 4,000 children and their families annually.

The devastating impacts of hearing impairments on children and their families are

well documented (Bailey & Simeonsson, 1988; Blair, 1981; Clark, 1989; Featherstone, 1980; Luterman, 1979; Stoneman & Brody, 1984; Turnbull & Turnbull, 1988). Not only does the hearing impaired child need early intervention to stimulate communication and cognitive development, but the parents need support and guidance in adjusting to having a hearing impaired child and in promoting the child's development. SKI*HI is based on a theoretical framework which assumes that early identification and provision of family-focused home programming will ameliorate the negative effects of hearing impairment on the child, enabling family members to adjust to the impairment and support and enjoy the child, as well as promoting the child's development. This theoretical framework is strongly supported in the literature (Bailey & Simeonsson, 1988; Grant, 1987; Luterman, 1987; Simmons-Martin, 1983; Stein, Clark, & Kraus, 1983; Tingey, 1988).

Features: How the Program Operates: Project SKI*HI is a home intervention delivery model for families of hearing impaired children consisting of: (a) identification/screening; (b) direct services in the home for hearing impaired children and their families; (c) support services (e.g., physical and occupational therapy, audiological services, medical and psychological support services) to the child; and (d) a program management system (see Figure 1).

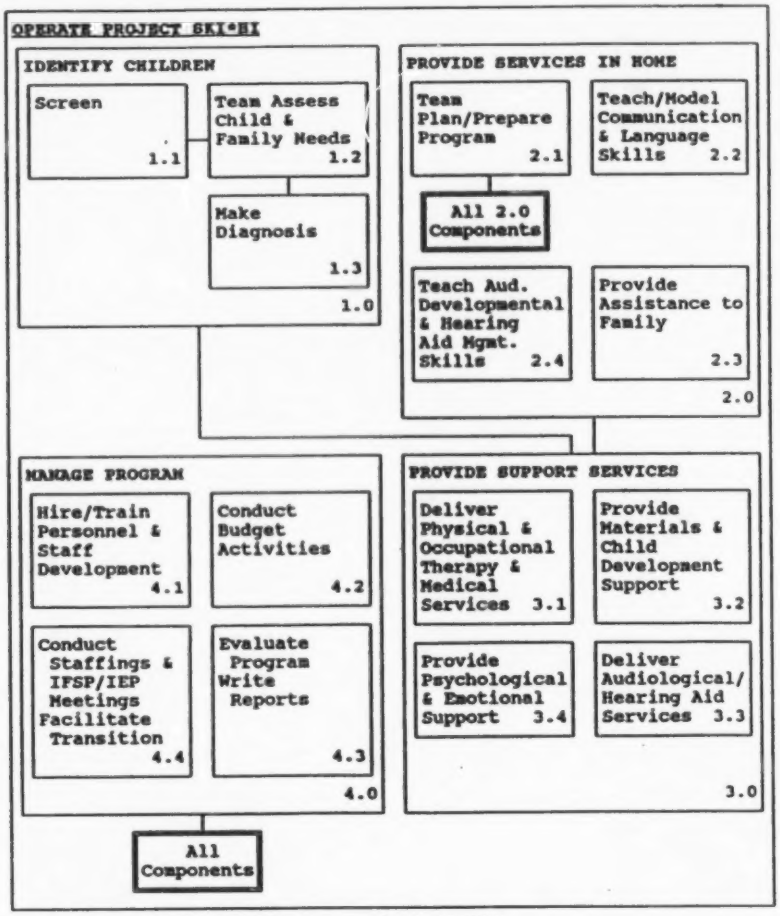
OPERATE PROJECT SKI*HI
IDENTIFY CHILDREN
Screen 1.1
Team Assess Child & Family Needs 1.2
Make Diagnosis 1.3
1.0
PROVIDE SERVICES IN HOME
Team Plan/Prepare Program 2.1
Teach/Model Communication & Language Skills 2.2
All 2.0 Components
Teach Aud. Developmental & Hearing Aid Mgmt. Skills 2.4
Provide Assistance to Family 2.3
2.0
MANAGE PROGRAM
Hire/Train Personnel & Staff Development 4.1
Conduct Budget Activities 4.2
Conduct Staffings & IFSP/IEP Meetings Facilitate Transition 4.4
Evaluate Program Write Reports 4.3
4.0
PROVIDE SUPPORT SERVICES
Deliver Physical & Occupational Therapy & Medical Services 3.1
Provide Materials & Child Development Support 3.2
Provide Psychological & Emotional Support 3.4
Deliver Audiological/ Hearing Aid Services 3.3
3.0
All Components

Figure 1. Program design for Project SKI*HI.

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The program's four major components are discussed below:

Identify Children (1.0): Hearing impaired children are identified as close to birth as possible through computerized high-risk hearing screening, public awareness, and referral systems. When a hearing impaired child is identified by or referred to the SKI*HI Program, a parent advisor is assigned to visit the home within a day or two of the referral to get acquainted with the family, extend support, and begin to establish rapport. Through an appropriate multidisciplinary team, the child's eligibility is determined and his or her functional levels of audition, cognition, speech/language, emotional, fine/gross motor development, and self-help skills are assessed. The program's staff assists the family through a collaborative goal-setting process called the Family Focused Interview (Winton, 1988) through which family strengths and needs are assessed.

Provide Services in Home (2.0): Once a child has been identified and diagnosed, the child and family enter the program through a process that consists of an initial staffing in which members of a multidisciplinary team convene to examine the results of a complete assessment of the child and family. An Individualized Family Service Plan (IFSP) and/or Individualized Education Plan (IEP) is formulated and goals are identified.

A local parent advisor (PA) delivers home services to the hearing impaired child and his or her family. The PA visits the home on a weekly basis and works primarily with the parents of the hearing impaired child, focusing on the curricular areas of communication, cognition, auditory, and language development, and hearing aid management. The PA describes and demonstrates for the parents specific methods for managing the child and facilitating growth. Parents practice new skills with the PA and work on parent-selected challenges during the week. Learner materials used to promote development include illustrated lesson summary/challenge sheets, visual aids, a parent resource book, and materials already in the home.

Progress data are collected on a weekly basis by the PA. This information, as well as periodic assessment information from other team members, including the parents, is discussed at regular staffings and guides the team in planning educational programs specific to the needs of each child and family.

Assessment data are reported annually to the SKI*HI Institute Data Center on specially designed forms (see Appendix A) for program evaluation purposes. The data are analyzed and reported for children nationwide and for children at individual sites.

Provide Support Services (3.0): As appropriate, physical/occupational therapy, audiological/hearing aid, medical, child development, and psychological/emotional services are provided directly or arranged for by SKI*HI support staff. A comprehensive hearing aid evaluation system and a loaner bank ensure that appropriate amplification is provided and that each child can have back-up amplification when a hearing aid is being repaired or changed. Support staff are involved in initial and ongoing assessments and may accompany the PA on home visits to provide assistance in assessing and meeting child and family needs.

Manage Program (4.0): Administrative tasks are performed by a program director at each site who manages the functioning of the program, coordinates efforts among program components, conducts budget activities, and prepares reports and/or proposals. Additionally, the director is responsible for conducting IFSP/IEP meetings and for seeing that adequate preparation is made for transition, typically to a center-based preschool, when home intervention is completed. S/he supervises recruitment of qualified PAs, initial training, and staff development including periodic inservice training workshops. The director establishes the service delivery and supervision system and oversees it to ensure its effectiveness.

Significance of Program Design as Compared to Similar Programs:

Innovation/Responsiveness to State-of-the-Art Standards: Because of P.L. 99-457, state and local education agencies are now, more than ever before, faced with the challenge of providing appropriate services to handicapped children, birth to 5 years of age. For 3- to 5-year-old handicapped children, both the home and the school or center have been recognized as viable educational settings. For most handicapped children in the 0- to 3-year-old age group, however, the home is generally regarded as the appropriate educational setting (Dunst, 1987; Karniski, 1986). In a review of published reports on early intervention programs for 0- to 5-year-old handicapped children done at the SKI*HI Institute, it was determined that only 20% of these programs are home based. The SKI*HI Program is a widely used home program for children who are hearing impaired and fills an important place in states' early childhood programming. The child identification, home services, support services, and program management components of SKI*HI are all directed towards effective interagency cooperation. Its use of the parent advisor as the family's consistent contact with service programs has proven to be a significant strength in the eyes of parents and program administrators (Clark, 1989).

Other state-of-the-art features include: (a) home programming specifically designed for all family members (note: the Carolina Institute for Research determined that most projects for handicapped children nationwide focused almost exclusively on the child and rarely included goals and activities for the family [Bailey et al., 1987]); (b) a full battery of curricular materials, including curriculum manuals, state-of-the-art home sign videos, monographs, and a Language Development Scale that have been nationally field tested and used successfully in SKI*HI replication programs; (c) a comprehensive program for the training of new parent advisors by nationally certified trainers; (d) a product development system that is sensitive to needs emerging in the field and in the literature and includes a careful field-testing process; and (e) a complete home management system that is used to plan and coordinate full services for hearing impaired children.

Cost Effectiveness: A distinguishing factor of SKI*HI is its cost effectiveness. The earlier the handicapped child is served, the less the cost. The fact that SKI*HI treatment begins at birth contributes greatly to its cost effectiveness. In addition to increased SKI*HI cost effectiveness due to early programming, home-based programming has been shown to be more cost effective than center-based programs. Singer and Raphael (1988) reported that the average cost per handicapped child per year in a school setting is $7,577. This compares to per-child costs averaging $1,480 for SKI*HI home-based programs serving hearing impaired children 0 to 5 (Watkins, 1988). In the Utah Parent-Infant Home Visit Program for hearing impaired children, the cost per child for 11 months of service averages $1,500, whereas the average annual cost per child at the Utah School for the Deaf is $12,000 (Clark, 1986).

POTENTIAL FOR REPLICATION

Settings and Participants (Development and Evaluation Sites): The SKI*HI Model has been replicated by 220 agencies in 42 geographically spread states. Thus, the socioeconomic, ethnic, and geographic makeup of agencies using the SKI*HI Model is representative of the total population in this country. The demographic characteristics of the population of hearing impaired children in SKI*HI programs include the following: (a) ethnicity--72% caucasian, 16% Black, 9% Hispanic, and 3% "other"; (b) sex--54% male; (c) type of hearing loss--87% sensorineural, 9% mixed, and 5% conductive; (d) severity of hearing loss--26% profound, 43% severe, 21% moderate, and 10% mild; (e) other handicapping conditions--21% had other handicapping conditions; (f) deafness in family--for 6%, one or both parents

were deaf; and (g) age--average age of entry into the program was 26 months.

Replicable Components and Documentation: Replication of the direct-service component of the SKI*HI Model is a requirement for adoption sites. The identification, support-services, and program-management components are also replicable, and sites are encouraged to replicate all components. Complete support materials are available for replication.

User Requirements: The minimum requirements for adoption are (a) letter of request for services; (b) a completed adoption agreement stating commitment to delivery of SKI*HI services in a weekly home-visit format to children with hearing impairments and their families; (c) 7-days training of direct-service delivery staff; (d) necessary administrative and support staff and facilities; and (e) acquisition of SKI*HI manual and other teaching/testing materials.

Costs (for Implementation and Operation): Material costs are minimal--that is, $120 for all start-up materials per service-delivery person. There are no training costs--that is, no fees are charged. The only costs are local transportation and lodging. The average cost per child for 11 months of service is $1,480 which includes the parent advisor's salary, transportation, and materials; equipment (e.g., loaner aids); and supervisory, secretarial, and support services (e.g., audiologist or psychologist).

EVIDENCE

The major accomplishments of Project SKI*HI are presented in the claim statements below.

Claim Statement No. 1: Hearing impaired preschool children who received SKI*HI programming have shown improvement in receptive and expressive language scores as evidenced by (a) higher rates of development during intervention than prior to intervention; (b) greater gains in development than what would be expected due to maturation alone; (c) statistically significant pre/post developmental gains; and (d) moderate-to-large effect sizes (standardized mean differences [SMDs]).

Design: In lieu of comparison groups, because services to identified children could not be denied ethically in light of earlier evidence of program effectiveness (JDRP certification of SKI*HI, 1978, 1984), the pre/post gains of SKI*HI children were studied in four ways. First, for each child in the program, intervention developmental rate was compared with pretest developmental rates. Second, mean posttest scores were compared to predicted posttest scores. The predicted mean scores indicated what the children would have scored as a result of maturation alone (Sheehan, 1979). Third, differences between the mean pre- and posttest scores were examined to determine if the differences were statistically significant. Fourth, SMDs were computed to determine the magnitude of the pre- to posttest gains in standard deviation units.

Sample: All children who received SKI*HI intervention since Fall, 1986, and for whom pre- and posttest data were submitted to the SKI*HI National Data Bank, were included in the overall sample. Data were submitted by 97 different sites located in 23 states for a total of 1,934 children. Data were analyzed separately for five states (i.e., Arkansas, Oklahoma, Tennessee, Texas, and Utah) to demonstrate the replicability of program effectiveness across different states. These states were selected because data had been submitted for three consecutive years (i.e., 86-87, 87-88, and 88-89) and because sample size was greater than 25 children in each state.

Instruments and Procedures: When Project SKI*HI was first validated in 1979, the primary measure of both expressive and receptive language (up to the language age of 36 months) was the Receptive-Expressive Emergent Language Scale (REEL). The REEL was standardized on normal hearing children. By the time of SKI*HI revalidation in 1984, this instrument had been replaced by the Language Development Scale (LDS), which was developed by Project SKI*HI and validated specifically for young hearing impaired children. Tonelson and Watkins (1979) obtained internal consistency coefficients of .91 and .93 for the LDS receptive and expressive scales, respectively. Inter-examiner agreement was 80% and 78% for the receptive and expressive scales, respectively. The concurrent validity of the LDS was estimated by correlating scores on the LDS with scores on the REEL. Coefficients of .78 and .79 were obtained for the receptive and expressive scales, respectively. No inter-examiner agreement data for the parent advisors who recorded scores for this report are available.

Data Collection: As general SKI*HI procedures, at each project site, demographic, LDS test, child development, and parent skill data are collected by the PA on forms designed specifically for submission to the SKI*HI Data Bank (see Appendix A). The PAs receive thorough training in the completion and submission of the data sheets. All testing is done by the parent in conjunction with the SKI*HI PA who makes weekly visits to the home. Because the PA administers all annual pre- and posttests, in conjunction with the parent, and records weekly parent and child progress data, the PA knows the child's pretest scores (i.e., examiners with no knowledge of pretest scores are not used). Replication site personnel submit the data to the SKI*HI Data Bank annually for analysis. When data are received at the SKI*HI Institute national data bank, carefully trained data coders encode the data onto a Data Coding Instrument. Intercoder agreement checks for every 20 data sheets were conducted prior to computer entry (intercoder agreement was consistently above 90%) and disagreements were resolved. Furthermore, all computer entries were checked for accuracy.

Data Analysis: First, LDS test scores were transformed to Intervention Efficiency Indices (IEI) (Bagnato & Neisworth, 1980) by dividing the developmental gain between the pretest and the posttest by the time between the pretest and the posttest. The IEI was then divided by the pretest developmental rate (PDR). The PDR was computed by dividing the pretest developmental age by the pretest chronological age. These transformations yielded Proportional Change Indices PCIs.

$$IEI/PDR = PCI$$

Children whose rates of development were slower during intervention than at pretest received a PCI of less than 1.0, and those whose rates of development accelerated during intervention received a PCI greater than 1.0 (Wolery, 1983).

Second, observed LDS receptive and expressive posttest scores were compared to predicted posttest scores. As for the first data analysis, each child's pretest developmental rate (PDR) was determined by dividing his or her developmental age by the chronological age. The posttest chronological age of the child, in months, was then multiplied by the PDR to determine a predicted posttest score. The predicted posttest score was used as a standard against which to compare the observed posttest score.

An inherent problem in the analysis of progress for infants and young children is maturation. Sheehan (1979) suggested using initial testing information for predicting a child's performance in the future and for comparing pretest developmental rates with developmental rates during intervention. The procedure has been criticized because it is based on the assumption that development occurs at a consistent rate and, therefore, it does not address the problem of growth spurts. It should be remembered that chances of growth spurts are equally distributed at pre- and posttest times. In the case of pretest

scores, the growth spurt would be reflected in the developmental rate which would then be reflected in the predicted posttest score. Strong correlations, ranging from .90 to .93, between pre- and posttest scores were obtained, further supporting this argument. In conjunction with the other analyses, the comparison of observed with predicted posttest scores provides an indication of program effectiveness as compared to what would be expected due to maturation alone.

Third, dependent t-tests were used to determine if the differences between the pre- and posttest LDS receptive and expressive mean scores were statistically significant.

Finally, SMDs were calculated, by dividing the difference between the pre- and posttest means by the pretest standard deviation, to determine the magnitude of the difference between the mean scores. Cohen's (1988) standards of .2 as a small effect size, .5 as a medium effect size, and .8 as a large effect size were used as arbitrary, though reasonable, criteria to judge the magnitude of SMDs.

Results: Median PCIs for receptive and expressive LDS scores are presented in Table 1. Although the means were consistently larger than the medians, they are not reported here because the median more validly reflects average performance when a distribution of scores is skewed. All median PCIs except one (Utah, LDS receptive, 1986-87) indicate accelerated rates of development for hearing impaired preschool children during their SKI*HI treatment.

Table 1
Median Proportional Change Indices (PCIs) by Year, Overall and by Selected States

	LDS Receptive			LDS Expressive		
STATES	1986-87	1987-88	1988-89	1986-87	1987-88	1988-89
Overall	1.6 (n=510)	1.7 (n=574)	1.5 (n=548)	1.6 (n=513)	1.7 (n=573)	1.6 (n=546)
Arkansas	1.2 (n=62)	1.2 (n=56)	1.1 (n=38)	1.5 (n=62)	1.2 (n=56)	1.2 (n=38)
Oklahoma	2.4 (n=21)	1.8 (n=27)	1.7 (n=15)	1.8 (n=23)	1.8 (n=27)	1.5 (n=14)
Tennessee	1.1 (n=51)	1.7 (n=89)	1.3 (n=102)	1.5 (n=51)	2.0 (n=89)	1.3 (n=102)
Texas	1.7 (n=125)	1.7 (n=128)	1.4 (n=166)	1.6 (n=125)	1.7 (n=128)	1.8 (n=166)
Utah	1.0 (n=91)	1.9 (n=83)	2.0 (n=33)	1.3 (n=92)	1.3 (n=82)	2.7 (n=32)

Note: n = sample size. Average treatment time = 6.7 months.

The results of the second analysis, mean observed versus predicted LDS posttest scores, are provided in Table 2. For all comparisons, SKI*HI children consistently scored higher at posttest than was predicted based on maturation alone.

Table 2
Mean Observed and Predicted LDS Posttest Scores by Year, Overall and by Selected States

	LDS Receptive			LDS Expressive		
STATES	86-87	87-88	88-89	86-87	87-88	88-89
Overall						
Observed:	26.88	26.90	26.54	24.85	24.90	24.38
Predicted:	23.84	23.91	23.81	21.87	21.85	21.87
Arkansas						
Observed:	30.32	31.97	33.13	27.42	29.61	30.77
Predicted:	28.67	30.12	32.55	25.58	27.61	29.54
Oklahoma						
Observed:	26.57	28.52	30.13	23.91	26.37	27.73
Predicted:	22.77	26.23	27.84	20.31	23.58	26.47
Tennessee						
Observed:	23.52	24.69	27.25	21.69	22.86	25.18
Predicted:	18.72	20.83	25.70	17.52	18.30	23.83
Texas						
Observed:	23.52	22.45	22.66	21.58	20.48	21.20
Predicted:	20.04	19.23	19.71	18.62	17.47	17.85
Utah						
Observed:	27.36	30.92	33.82	25.09	28.61	29.81
Predicted:	25.84	28.03	29.48	23.00	26.16	25.65

Table 3 presents the results for the third and fourth analyses. For the sites overall and for the five selected states (see Appendix B), all differences between mean pre- and posttest LDS scores (see Table 3; see Appendix B for data by states) were statistically significant ($p \leq .001$).

In addition, for the subjects overall (Table 3), the magnitude of the differences in standard deviation units was moderate (SMDs ranged from .55 to .62) by Cohen's (1988) standards. SMDs for the five selected states (see Appendix B) were small to large (SMDs ranged from .35 to .85, with a mean SMD = .60).

Table 3
Mean Pre-Posttest Comparisons and SMDs for LDS Scores by Year for Sites Overall

	LDS Receptive in Months			LDS Expressive in Months		
	86-87	87-88	88-89	86-87	87-88	88-89
Overall						
Pre $\bar{X}$ (sd)	20.04 (12.25)	19.59 (12.22)	19.48 (12.02)	18.35 (11.74)	17.77 (11.43)	17.86 (11.16)
Post $\bar{X}$ (sd)	26.88 (13.68)	26.90 (13.46)	26.54 (13.39)	24.85 (13.52)	24.88 (12.98)	24.38 (12.64)
SMD	.56*	.60*	.59*	.55*	.62*	.58*
n	559	596	557	559	596	557

*Associated mean score differences are statistically significant, $p \leq .001$. n = sample size.

Supplementary Evidence: Information from one additional source provides supplemental evidence that SKI*HI children make substantial developmental progress during SKI*HI programming. This evidence is provided by analyses of the relationship between the number of home visits and pre- to posttest LDS gain scores. Number of home-visit data have been collected for 1987-88 and 1988-89 years only. A two-way analysis of covariance with repeated measures, using time-in-treatment as a covariate, was conducted. The within-subjects factor was testing (i.e., pre- and posttest scores) and the between-subjects factor was number of home visits, with three levels consisting of 0-12 sessions, 13-19 sessions, and greater than 19 sessions (the levels were determined by dividing the number-of-sessions distribution into thirds). All interactions between number of home visits and testing were statistically significant, indicating that gains from pre- to posttest were not consistent across the levels of home visits. Inspection of the histograms showing the gains for each number-of-home-visits level (see Appendix C, Figure 2) indicates that even when time in treatment is held constant, expressive and receptive language gains increased as number of home visits increased. The greatest gains were made by children with greater than 19 home visits, thus providing corroborative evidence that SKI*HI home visits positively affect the language development of the preschool hearing impaired child.

Claim Statement No. 2: Hearing impaired preschool children who received SKI*HI programming demonstrated an increase in auditory development level, communication-language development level, and vocabulary level as compared to levels at time prior to treatment.

Design, Instruments and Procedures, and Data Collection: Child development levels and date of acquisition are recorded by PAs who are trained to teach parents about the developmental levels and to assess children's acquisition of new levels of development as part of their weekly visits. Information regarding 11 auditory development levels, 12 communication-language development levels, and 8 vocabulary levels is recorded (see Appendix A). The child's developmental level at the start of the program (i.e., first entry in the Child Data section of the SKI*HI Data Sheet) was compared with the latest developmental level entered on the data sheet.

Sample: The sample was the same as that used for Claim Statement 1. However, fewer PAs completed the child and parent data sections of the SKI*HI Data Sheet, as compared to the demographic and test data sections, because the PAs are not required to do so for data submission to the national data bank. The number of children for whom data were submitted are provided in Table 4.

Analysis/Results: The mean and median auditory, communication-language, and

vocabulary levels acquired and the average time (in months) for acquisition are provided in Table 4. For the sites overall, the typical SKI*HI child increased (a) three auditory levels, with an average time interval of 4.9 months (median of 3 months); (b) three communication-language development levels, with an average time interval of 6.6 months (median of 5 months); and (c) two vocabulary development levels with an average time interval of 6.4 months (median 5 months). Histograms showing the changes from program start to latest entry are provided in Appendix D. Data for the selected states are provided in Appendix E.

Table 4
Average Child Auditory, Communication-Language, and Vocabulary Acquisition for Sites Overall

Auditory Level			Communication-Language Level			Vocabulary Level		
Mean Beginning Auditory Level	Mean Ending Auditory Level	Mean Time Interval in Mos.	Mean Beginning Comm-Lang Level	Mean Ending Comm-Lang Level	Mean Time Interval in Mos.	Mean Begin. Vocab. Level	Mean Ending Vocab. Level	Mean Time Interval in Mos.
3.1[2] (2.9)	6.0[5] (3.5)	4.9[3] (5.7) n=746	4.0[3] (2.8)	7.1[7] (2.9)	6.6[5] (6.7) n=838	2.3[1] (2.1)	4.5[4] (2.5)	6.4[5] (6.4) n=811

Note: Medians are in brackets. Standard deviations are in parentheses. n = sample size.

Supplementary Evidence: Two additional types of information (i.e., percentage of children wearing their hearing aids full-time and the average amount of time until children wear their aids full-time) provide supporting evidence for increases in developmental gains during participation in the SKI*HI program. The PA records data regarding the amount of time the child wears his/her hearing aid per week and the dates when increased hearing-aid use occurred. For the sites overall (see Table 5), full-time hearing aid use was acquired by 60% of the children in an average time interval of 2.7 months (median of one month). At the end of the reporting year, the remaining 40% of the children were in the process of acquiring full-time hearing aid use and were wearing their hearing aids for varying amounts of time, depending upon their program-start date and progress within the program.

Table 5
Percentage of Children Wearing Hearing Aids Full-time and Mean Time in Months for Child to Wear Aid Full-time, Overall and by Selected States, Fall, 1986 through Spring, 1989

	Overall	Arkansas	Oklahoma	Tennessee	Texas	Utah
% of Children Wearing Hearing Aid Full-time	60% n=810	55% n=65	62% n=69	69% n=113	52% n=232	70% n=95
Mean Time in Months for Child to Wear Aid Full-time	2.7 [1.0] (4.2) n=482	5.4 [2.0] (7.8) n=36	2.5 [1.0] (3.6) n=43	1.5 [<1] (2.8) n=78	3.3 [1.0] (4.2) n=120	2.4 [1.0] (3.6) n=66

Note: Medians in brackets, standard deviations in parentheses. n = sample size.

Claim Statement No. 3: Parents of preschool hearing impaired children who received SKI*HI programming demonstrate the acquisition of new skills in the following areas: auditory stimulation, communication-language stimulation, cognition stimulation, either aural-oral or total communication stimulation, and hearing aid management.

Design, Instruments and Procedures, and Data Collection: Parent advisors are the source of parent-skill data. The number of new skills acquired are recorded by the PAs, who are trained to teach parents new skills and to assess parents' acquisition of new skills. This information was used to determine the number of new skills acquired per month in each of the following areas: auditory, communication, aural-oral language, total communication language, and cognition stimulation. As seen in Appendix A, 11 auditory skills are taught to parents, 15 communication skills, 9 aural-oral language skills, 20 total communication skills, and 12 cognition skills. In addition, data are collected on the home-visit number at which a parent achieves 80-100% competency on hearing aid management.

Sample: As for Claim Number 2, fewer PAs completed the child and parent data sections of the SKI*HI Data Sheet, because the PAs are not required to do so for data submission to the national data bank. The number of children for whom data were submitted are provided in Table 6.

Table 6
Mean Number of Parent Skills Acquired Per Month, Overall and by Selected States, Fall, 1986 through Spring, 1989

STATES	Mean Visit # Parent Achieves 80-100% HA Competency	Mean # New Auditory Skills Acquired Per Month	Mean # New Communication Skills Acquired Per Month	Mean # New Aural-Oral Lang. Skills Acquired Per Month	Mean # New Total Comm. Lang. Skills Acquired Per Month	Mean # New Cognition Skills Acquired Per Month
Overall	12 (9.8) n=372	1.4 (1.2) n=516	2.3 (2.0) n=669	1.9 (1.6) n=258	1.8 (1.5) n=270	2.8 (3.0) n=89
Arkansas	9 (7.8) n=38	1.1 (1.3) n=38	2.1 (2.4) n=47	1.3 (1.2) n=21	1.7 (1.6) n=16	_____ _____
Oklahoma	11 (6.2) n=34	1.4 (1.2) n=41	2.1 (1.5) n=53	2.1 (2.1) n=29	1.4 (1.3) n=19	3.9 (4.6) n=10
Tennessee	15 (7.6) n=54	1.4 (1.3) n=74	2.5 (2.0) n=101	1.7 (0.9) n=39	1.5 (1.3) n=37	3.2 (2.8) n=16
Texas	10 (12.6) n=113	1.5 (1.3) n=173	2.4 (2.1) n=203	1.9 (1.5) n=79	2.0 (1.8) n=118	2.4 (3.2) n=31
Utah	10 (2.6) n=8	1.2 (0.8) n=69	2.0 (2.0) n=80	1.9 (1.6) n=41	1.7 (1.1) n=23	2.2 (1.2) n=12

Note: Standard deviations in parentheses.

Analysis/Results: Means and standard deviations for the number of new skills acquired per month were calculated for the sites overall and for the five selected states for each of the areas of home programming (see Table 6). For the sites overall, the mean number of new skills acquired per month ranged from 1.4 to 2.8. For the five selected

states, the mean number of new skills acquired per month ranged from 1.1 to 3.9.

In addition, hearing aid management is taught to parents. The mean visit number at which parents achieved 80-100% competency on the hearing aid management test is provided in column 1 of Table 6. Overall, the mean visit number was 12. For the five states, mean visit numbers ranged from 9 to 15.

Claim Statement No. 4: Hearing impaired children receiving SKI*HI programming are identified as having a hearing loss at an early age (enabling the children to receive program services at an early age).

Design, Instruments and Procedures, and Data Collection: Parent advisors report age of identification of hearing loss and program-start date for children receiving SKI*HI programming. The Demographic section of the SKI*HI Data Sheet (see Appendix A) was used to obtain identification age and program-start age. This information was used to determine the mean and median ages of identification and the mean and median time intervals between identification age and program-start age.

Sample: The sample was the same as that used for Claim Statement 1.

Analysis/Results: Means, medians, and standard deviations for the age of identification, in months, were calculated for the sites overall and for the selected states (see Table 7). For the sites overall, the mean age of identification was 18.6 months, with a median of 17 months. The average time interval between identification and program-start date was 6.9 months with a median of 3 months, indicating that the average SKI*HI child received home programming by age 25 1/2 months (median of approximately 20 months). Sixty-nine percent of the overall sample were rated as having a severe-to-profound hearing loss. Because children with moderate and mild hearing losses are usually identified at a later age (Matkin, 1988), the age of identification reported here (which includes 31% of the children who were moderately and mildly hearing impaired) reflects favorably on SKI*HI procedures for early identification of hearing impaired children.

Table 7

Means, Medians, and Standard Deviations for Age of Identification, and Time Interval Between Identification Age and Program-Placement Age, Overall and by Selected States, in Months--Fall, 1986, through Spring, 1989

	Overall	Arkansas	Oklahoma	Tennessee	Texas	Utah
Mean Age of Identification	18.6 [17.0] (12.7) n=1519	18.0 [18.0] (12.7) n=124	21.3 [20.0] (15.5) n=93	17.9 [16.0] (11.6) n=130	17.8 [16.0] (12.4) n=491	19.9 [19.0] (15.3) n=101
Mean Time Between ID & Program Start	6.9 [3.0] (9.1) n=1511	7.1 [3.0] (10.2) n=124	9.0 [4.5] (10.3) n=92	6.1 [3.0] (7.6) n=129	5.8 [3.0] (7.1) n=488	7.5 [2.0] (12.5) n=100

Note: Medians in brackets, standard deviations in parentheses.

INTERPRETATION AND DISCUSSION

Relationship Between Effect and Treatment: SKI*HI children show higher rates of development during intervention than prior to intervention and greater gains in receptive and expressive language development than would be expected due to maturation alone. Also, they show mean pre- to posttest developmental gains that are statistically significant and pre-to posttest effect sizes that are moderate to large; (b) SKI*HI children show increased auditory, communication-language, and vocabulary developmental levels and increased full-time hearing aid use during SKI*HI programming; (c) SKI*HI parents show increased ability to manage their child's hearing handicap, stimulate communication-language skills, and promote their child's cognitive development during SKI*HI programming; and (d) SKI*HI children are identified at an early age and begin to receive home programming services promptly after identification. These program results achieve the program goals described on page 1.

Control of Rival Hypotheses: Evidence exists that the program results are attributable to SKI*HI intervention. Possible rival hypotheses to program effectiveness that were studied and ruled out are: (a) Testing: The testing effect includes teaching to the test or the practice effect. SKI*HI children do not take a test per se. Instead, their communication skills are observed in their home environment by the PA and the parent and communication level is recorded on the LDS testing form by the PA. Additionally, SKI*HI children are not "taught the test". The PA teaches the parents auditory, communication, cognitive, aural-oral or total communication facilitation skills. The parents then provide the children with stimulation throughout the day in the home environment; they do not teach the test. (b) Maturation: Children consistently demonstrated greater average gains than would be expected due to maturation alone and the rate of development during intervention was greater than developmental rate prior to intervention. (c) Selection: The threat of selection to the internal validity of these findings was not applicable, because there was no control or comparison group. (d) Attrition: All children for whom there was both pre-and posttest data were used; there is no reason to expect that SKI*HI children who dropped out of the program prior to posttest, or who entered the program mid-year and were only assessed once during the year, or for whom PAs did not report posttest data differed systematically from those who had both pre- and posttest data; (e) Instrumentation: Parent advisors are trained to collect demographic, parent, and child data, and instructions for completing the SKI*HI Data Sheet are provided in the SKI*HI manual for PAs. The instrumentation question of interest is whether the PAs' scores were reliable and valid (i.e., were the PAs affected by knowing the children)? Inter-examiner agreement data are only available for scores from children used in the LDS test validation study (Tonelson & Watkins, 1979). Pre- to posttest annual gains have been similar since 1979. (f) History: It is possible that other events, in addition to SKI*HI treatment, accounted for some of the gains. For 46% of the children, other services (e.g., preschool, mental health, social, or speech therapy) were obtained by the parents of children during SKI*HI programming. However, such services, as needed, are part of the support services provided to SKI*HI children (see Figure 1). (g) Regression: On average, SKI*HI children's LDS developmental quotients were more than two standard deviations below the mean of 100 at the pretest, so some regression toward the mean would be expected at posttest. A comparison was made of mean developmental gain for children whose quotients were more than one standard deviation below the mean at pretest with the mean developmental gain for those children whose quotients were higher than one standard deviation above the mean at pretest. For the receptive LDS scores, the children with low pretest quotients had an average gain of 7.2 months and the children with high pretest quotients had an average gain of 6.6 months. The gains are quite similar. Even

for children with high quotients at pretest, whose posttest scores would have regressed in a negative direction, mean gains were still substantial. Similar findings were obtained for the LDS expressive scores.

The generalizability of program results has also been well established. SKI*HI has been implemented in many diverse settings with racially and culturally different families.

EDUCATIONAL SIGNIFICANCE OF RESULTS

Relationship of Results to Needs. The results described in the Evidence Section show how SKI*HI programming meets the needs of young hearing impaired children and their families (see Needs Section, pages 1 and 2). The results are positive! SKI*HI does equip families to manage their child's handicap, communicate meaningfully with their child, and promote their child's development, and enables hearing impaired infants and toddlers to make substantial developmental growth.

Comparison of Results to Those of Other Programs. An exhaustive manual and computer search of the ERIC and ECER databases revealed only seven reports in which the effect of early home intervention on communication for hearing impaired preschoolers was investigated. In six of these reports, the effects of early (i.e., prior to 18 months of age) versus late (i.e., 18 months or older) intervention was the focus of the investigations. Consequently, the findings from these six reports cannot be compared to the findings reported here. The focus of one investigation was comparable. McConnell (1974) provided a parent-oriented program and audiological management for 94 severe-to-profoundly hearing impaired preschoolers in a demonstration home. The authors reported an average gain in language age of 20.8 months at the end of an average instructional interval of 27.8 months, indicating less than one month of gain for every month of instruction. In comparison, average pre- to posttest gains for SKI*HI children who were visited by PAs in their own home were approximately one month for every month of SKI*HI programming (see Table 3 and Appendix B), PCIs indicated accelerated rates of development during intervention (see Table 1), and average observed posttest scores were consistently higher than was predicted based on maturation alone (see Table 2).

With respect to child-developmental-level or parent-skill acquisition data, no studies were located to provide a comparison for the data reported here.

With respect to the findings regarding age of identification, prior to SKI*HI programming in Utah, the average age of identification of hearing loss was 36 months. Utah now reports an average identification age of 19.9 months (see Table 7). From a national perspective, according to a report released in 1988 by the Commission on Education of the Deaf to the President and the Congress of the United States, "the average age of identification for profoundly deaf children in the United States is reported as 2 and 1/2 years" (p. 3). In comparison, the average age of identification for SKI*HI children was 18.6 months (see Table 7). This low age of identification may be attributable to a combination of factors: the early identification procedures used in SKI*HI and the public and professional awareness resulting from the availability of such an effective early intervention program in states and regions.

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Child's Name: _____

SKI*HI DATA SHEET

DEMOGRAPHICS-I 1. Site Prefix (3 letters)_____ 2. Child ID #_____ 3. Date of birth_____ 4. Sex_____ 5. Program Start Date_____ 6. Date of ID_____ 7. Other handicaps_____
8. Date Hearing Aid Fit_____ 9. One or Both Parents Deaf: Yes / No (circle one) 10. Date of Suspicion_____ 11. Type of Loss: Sensori-neural / conductive / mixed (circle one) 12. Cause of Loss_____
13. Date of "Cause" if Occurred after Birth_____ 14. Race_____ 15. Language Spoken in the Home_____

DEMOGRAPHICS-II (Fill in at program initiation and thereafter whenever additions/changes are made):

1. Hearing Loss (dB numerical values; use best ear; circle if ave. of 2 frequencies or less):

Test Date	Unaided dB	Test Date	Aided dB

2. Communication Methodology: Date Begun:
Diagnostic/prescriptive _____
Aural-Oral _____
Total Communication _____
Other _____ _____

3. Other Non-Parent Infant Program Services: Date Begun:
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

4. Frequency of Home Visits: Date Begun:
( ) twice a week _____
( ) once a week _____
( ) every other week _____
( ) other_____ _____

5. Graduation Date _____

TEST DATA (Write down scores and dates of tests)

LDS:

Test Date*	RA	EA

(highest month in age interval)

Other Tests:

Test name	Test Date	Results

CHILD DATA (Slash item if no longer reporting. Leave blank if child not yet achieved.) (Visit #)

	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date	#___ Date
Time Hearing Aid Worn. Begin recording after H.A. Prog. initiated. Write # of appropriate time interval. See back. Discontinue (slash) when child achieves 100%.																	
Auditory Development Begin recording after Aud. Prog. initiated. Write highest level child achieves (1-11). See back.																	
Communication-Language Development Begin recording after Comm. Prog. initiated. Write highest level child achieves (1-12). See back. Write # of appropriate vocabulary interval. See back. Discontinue (slash) when child has over 300 words.	Communication-Language Level:																
	Vocabulary:																

PARENT DATA (Begin recording after each program initiated. Slash item if no longer reporting. Leave blank if not yet achieved.)

Hearing Aid Skills: Visit # parent achieves 80-100% on hearing aid competency test:_____

New Auditory Skills acquired (1-11). See back.																	
New Communication Skills acquired (1-12). See back.																	
New Aural-Oral Language Skills acquired (1-9). See back.																	
New Total Communication Skills acquired (1-20). See back.																	
New Cognition Skills acquired (1-12) Optional. See back.																	

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Appendix B

Pretest-posttest Comparisons and Standardized Mean Differences (SMDs) for LDS Scores by Year, Overall and by Selected States

STATES	LDS Receptive in Months			LDS Expressive in Months		
	86-87	87-88	88-89	86-87	87-88	88-89
Overall						
Pre $\bar{X}$ (sd)	20.04 (12.25)	19.59 (12.22)	19.48 (12.02)	18.35 (11.74)	17.77 (11.43)	17.86 (11.16)
Post $\bar{X}$ (sd)	26.88 (13.68)	26.90 (13.46)	26.54 (13.39)	24.85 (13.52)	24.88 (12.98)	24.38 (12.64)
SMD	.56*	.60*	.59*	.55*	.62*	.58*
n	559	597	558	562	596	557
Arkansas						
Pre $\bar{X}$ (sd)	23.36 (11.34)	24.07 (14.17)	25.18 (14.24)	20.84 (10.98)	21.96 (13.24)	22.87 (13.16)
Post $\bar{X}$ (sd)	30.32 (12.78)	31.96 (15.17)	33.13 (16.55)	27.42 (12.37)	29.61 (14.83)	30.77 (15.58)
SMD	.61*	.56*	.56*	.60*	.58*	.60*
n	62	57	39	62	57	39
Oklahoma						
Pre $\bar{X}$ (sd)	18.48 (12.47)	20.22 (10.83)	23.33 (15.60)	16.52 (13.08)	18.37 (10.98)	22.27 (15.53)
Post $\bar{X}$ (sd)	26.57 (14.14)	28.52 (12.67)	30.13 (15.52)	23.91 (15.03)	26.37 (13.03)	27.73 (15.30)
SMD	.65*	.77*	.44*	.57*	73*	.35*
n	21	27	15	23	27	15
Tennessee						
Pre $\bar{X}$ (sd)	18.20 (11.07)	18.55 (10.38)	21.70 (10.75)	17.01 (10.51)	16.31 (9.31)	20.15 (10.26)
Post $\bar{X}$ (sd)	23.52 (12.37)	24.69 (11.47)	27.25 (10.91)	21.69 (12.00)	22.86 (10.72)	25.18 (10.66)
SMD	.48*	.59*	.52*	.45*	.70*	.49*
n	71	98	107	71	98	107
Texas						
Pre $\bar{X}$ (sd)	16.22 (9.31)	14.86 (9.17)	15.47 (9.49)	14.91 (8.65)	13.50 (8.77)	13.94 (8.55)
Post $\bar{X}$ (sd)	23.53 (11.38)	22.45 (10.93)	22.66 (10.79)	21.58 (11.02)	20.48 (10.68)	21.20 (10.55)
SMD	.79*	.83*	.76*	.77*	.80*	.85*
n	143	137	170	143	137	170
Utah						
Pre $\bar{X}$ (sd)	21.82 (12.49)	23.71 (14.66)	26.36 (14.01)	19.30 (11.99)	21.66 (13.85)	22.88 (11.84)
Post $\bar{X}$ (sd)	27.36 (13.32)	30.92 (15.40)	33.82 (15.56)	25.09 (12.90)	28.61 (15.06)	29.81 (13.41)
SMD	.44*	.49*	.53*	.48*	.50*	.59*
n	91	83	33	92	82	32

Note: *Associated mean score differences are statistically significant, $p \leq .001$. Average annual treatment time = 6.7 months.

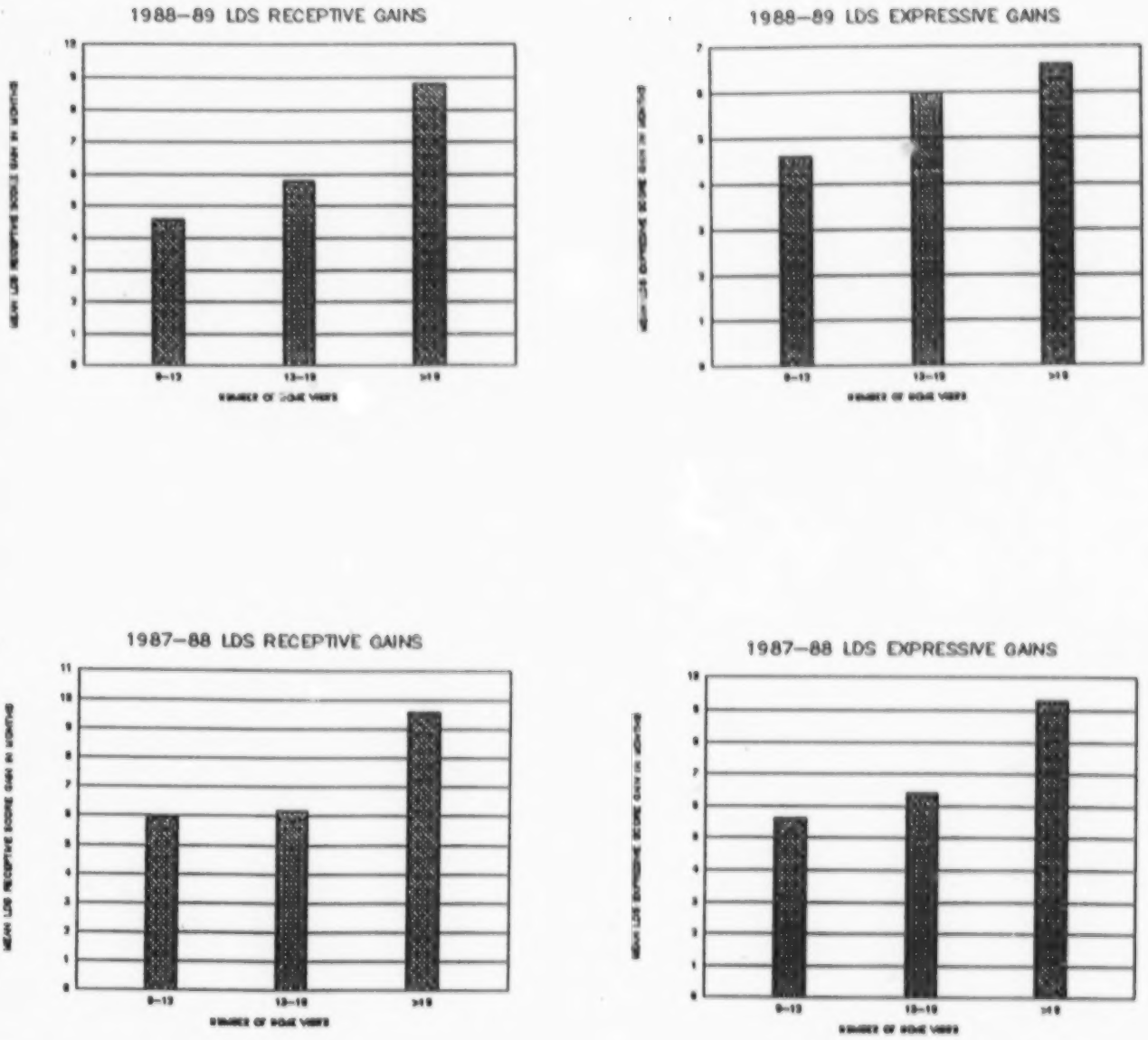
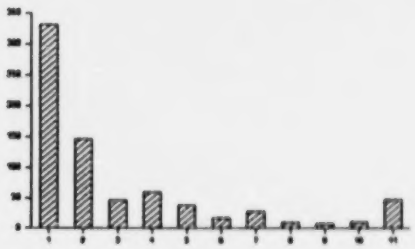
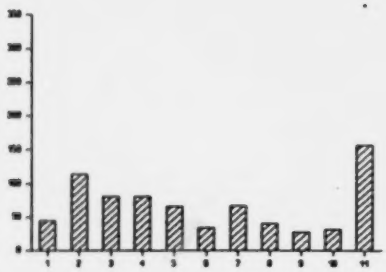


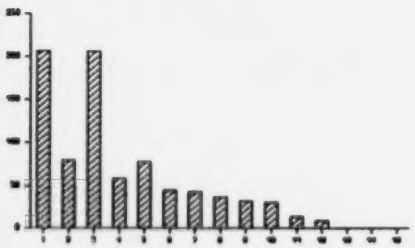
Figure 2. Histograms showing average gain for each of the number-of-home-visit levels. Average amount of treatment time = 6.7 months.



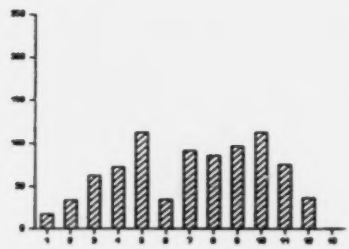
Highest auditory level at start of auditory program.



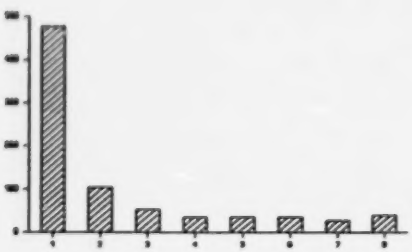
Highest auditory level at time of latest entry. (Note: average time interval of 4.9 months - median of 3 months).



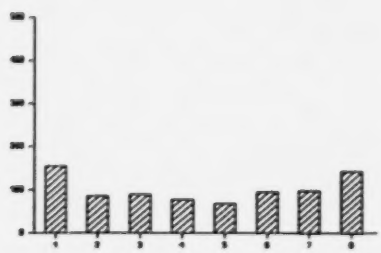
Highest communication-language level at start of communication program.



Highest communication-language level at time of latest entry. (Note: average time interval of 6.6 months - median of 5 months).



Highest vocabulary level at start of communication program.



Highest vocabulary level at time of latest entry. (Note: average time interval of 6.4 months - median of 5 months).

Figure 3. Histograms showing frequencies of children at start of program and at time of latest entry for highest auditory level, highest communication-language level, and highest vocabulary level.

APPENDIX E

Mean Child Auditory, Communication-Language, and Vocabulary Level Acquisition, Overall and by Selected States

	Overall	Arkansas	Oklahoma	Tennessee	Texas	Utah
			Auditory Level			
Mean Beginning Auditory Level	3.1[2] (2.9)	2.7[1] (2.6)	3.6[2] (3.5)	3.1[2] (2.6)	2.2[1] (2.2)	4.7[3.5] (3.8)
Mean Ending Auditory Level	6.0[5] (3.5)	5.9[5] (3.1)	6.5[5] (3.6)	6.1[6] (3.3)	5.1[4] (3.3)	8.0[10] (3.4)
Mean Time Interval in Months	4.9[3] (5.7) n=746	8.7[7] (8.0) n=65	4.2[3] (4.7) n=58	5.7[4.5] (5.2) n=100	4.2[2] (5.2) n=245	5.7[4] (5.6) n=106
			Communication-Language Level			
Mean Beginning Comm-Lang Level	4.0[3] (2.8)	3.7[3] (2.9)	4.7[4] (3.3)	3.9[3] (2.5)	3.1[3] (2.5)	5.0[4] (3.3)
Mean Ending Comm-Lang Level	7.1[7] (2.9)	7.8[8] (2.6)	7.4[8] (3.1)	7.5[8] (2.5)	6.4[7] (3.0)	8.1[9] (3.2)
Mean Time Interval in Months	6.6[5] (6.7) n=838	11.8[8] (10.1) n=66	5.5[4] (5.2) n=71	8.5[7] (7.1) n=114	6.0[4] (6.3) n=257	6.2[5] (5.7) n=109
			Vocabulary Level			
Mean Beginning Vocabulary Level	2.3[1] (2.1)	2.3[1] (2.1)	3.2[1] (2.8)	2.2[1] (1.9)	2.0[1] (1.8)	2.4[1] (2.4)
Mean Ending Vocabulary Level	4.5[4] (2.5)	5.1[5.5] (2.6)	4.9[5] (2.7)	4.9[5] (2.3)	4.1[4] (2.4)	4.2[4] (2.7)
Mean Time Interval in Months	6.4[5] (6.4) n=811	10.0[8] (7.6) n=68	6.3[4] (6.8) n=70	7.4[7] (5.7) n=115	5.8[4] (6.4) n=246	6.6[5] (6.2) n=107

Note: Medians are in brackets. Standard deviations are in parentheses.

SKI*HI INSTITUTE

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Project SKI*HI, INSITE, REAP, VIP, Tactile Signing, NDN Developer Demonstrator, Early Intervention Inservice

January 29, 1991

Fran Kessler-Richardson
RMC Research Corporation
400 Lafayette Road
Hampton, NH 03842

FAX 603-926-4628

Dear Ms. Kessler-Richardson:

Thank you for your support and assistance with moving through the NDN Certification process.

We received seventeen (17) questions that the PEP submitted regarding SKI*HI's Recertification Statement dated June, 1990. We have responded to each question and are enclosing our responses to these questions. We have restated each question and then followed with our responses on the next 11 pages.

Sincerely,

Thomas C. Clark, Director
SKI*HI Institute

RESPONSE TO THE QUESTIONS SUBMITTED BY

THE PROGRAM EFFECTIVENESS PANEL

U.S. DEPARTMENT OF EDUCATION

CONCERNING THE RECERTIFICATION STATEMENT FROM PROJECT SKI*HI OUTREACH

PROGRAMMING FOR HEARING-IMPAIRED INFANTS AND FAMILIES

THROUGH HOME INTERVENTION

January 29, 1991

Each question is stated. Then our response follows.

1. How do you know this is a valid way of showing a posttest comparison (referring to page 7)? Because services to identified children could not be denied ethically in light of earlier evidence of program effectiveness, and after a careful consideration of the alternatives, a predictive model was selected. Without a comparison group, there are not many options for analysis. However, predictive models are common in the literature (e.g., Bryk & Weisberg, 1976; Bryk & Woods, 1980; Shonkoff & Hauser-Cram, 1989; Weisberg, 1974). Although we did not use regression analysis, there is still the notion of a predictive base in our analysis (Sheehan, 1979). In and of itself, a comparison of predicted versus observed (actual) means is not conclusive. But taken together with the other analyses, these data provide support for the claim that children with hearing impairments, receiving home intervention, improved in receptive and expressive language scores.

   With respect to the validity of such a comparison, local SKI*HI programs have used obtained versus predicted score information and other data that compare children to themselves in order to design program objectives. Because of the diversity among SKI*HI children, the emphasis on comparing children to themselves (such as comparing observed to predicted performances) is particularly appropriate.

2. How do you know if these gains are significant improvement (referring to page 8)? Did you do a significance test? If so, how did you do it? It is not clear what gains are referred to in this question. If the reference is to the comparison of observed with predicted posttest gains, please see our response to Question 5. If the reference is to gains indicated by the SMDs, these were tested for statistical significance and the results are reported in Table 3 and Appendix B. If the reference is to the data in Table 1, perhaps there is a misunderstanding of the data in that table. These are not change data, but are ratios of the Intervention Efficiency Index (i.e., the developmental gain between the pretest and posttest divided by the time between the pretest and the posttest) to the Pretest Developmental Rate (i.e., the developmental age divided by the chronological age). Mean ratios greater than 1.0 indicate that, on the average, the rate of development accelerated during intervention as compared to the rate of development at the pretest.

3. If home contacts are correlated with time in the program, then there will be a maturation effect in the data. Did you adjust for that? Yes, we adjusted for maturation. A two-way analysis of covariance with repeated measures, using time-in-treatment as a covariate, was conducted. That is, time-in-treatment was held constant across the three levels of number of sessions. (See page 10, Supplementary Evidence, for a description of that analysis.)

4. How do you transfer the children's identification process? That is, do parents call the program? Is it only the more concerned parents who participate? Adoption sites learn the identification processes through training and technical assistance. Identification occurs when audiological testing indicates the possibility of hearing loss. Several factors may lead to the audiological assessment of a child including:
   1. Doctors, health agencies, friends, or family members may refer the family or may suggest that the parents contact an audiologist or the SKI*HI program.
   2. A high-risk screening system may indicate a child is at risk and should be tested. The agency administering the screening protocol then contacts the parents and suggests that an appointment be made for evaluation. If a hearing loss is confirmed, then referral is made to the SKI*HI program.
   3. The parents may suspect a hearing impairment. They may call the doctor or the audiologist for an evaluation, who would in turn refer to a SKI*HI program if a hearing loss is confirmed, or may call the SKI*HI program directly.

   When a hearing loss has been confirmed, the program is explained to the parents and they choose whether to enroll. The program is at no cost to the parents and the program is delivered in the home. Parents with a wide range of concern, commitment, skill, knowledge, socioeconomic status, and psychoemotional state enter the program with their children. Although none of these attributes is measured, as such, by the program, there is no reason to believe that parents who choose to participate are consistently more concerned than parents who do not choose to participate.

   If "how do you transfer" means is this identification system usable in a variety of settings, the answer is "yes." Sites with access to child-find systems ranging from sophisticated and extensive to very restricted, and agencies relying mainly on public awareness and referral, have had effective SKI*HI programs. They have been able to tie into and in many cases help develop the identification process in order to get services to children and families as early as possible.

5. How much higher (referring to Table 2)? Is it significant? With respect to how much higher, for the children overall, the months by which the observed posttest means were higher than the predicted posttest means for the receptive and expressive scales ranged from 2.5 to 3.0. (See revised Table 2 below where we have added the pretest means and the calculated difference between observed and predicted posttest means for ease of comparison.)

Table 2
Mean Pretest, Observed, and Predicted LDS Posttest Scores and Mean Difference Between Observed and Predicted Scores by Year, Overall and by Selected States

	LDS Receptive			LDS Expressive		
STATES	86-87	87-88	88-89	86-87	87-88	88-89
Overall						
Pretest:	20.04	19.59	19.48	18.35	17.77	17.86
Observed:	26.88	26.90	26.54	24.85	24.90	24.38
Predicted:	23.84	23.91	23.81	21.87	21.85	21.87
Mean Difference:	3.04*	2.99*	2.73*	2.98*	3.05*	2.51*
Arkansas						
Pretest:	23.36	24.07	25.18	20.84	21.96	22.87
Observed:	30.32	31.97	33.13	27.42	29.61	30.77
Predicted:	28.67	30.12	32.55	25.58	27.61	29.54
Mean Difference:	1.65*	1.85*	0.58	1.84*	2.00*	1.23*
Oklahoma						
Pretest:	18.48	20.22	23.33	16.52	18.37	22.27
Observed:	26.57	28.52	30.13	23.91	26.37	27.73
Predicted:	22.77	26.23	27.84	20.31	23.58	26.47
Mean Difference:	3.80*	2.29*	2.29	3.60*	2.79*	1.26
Tennessee						
Pretest:	18.20	18.55	21.70	17.01	16.31	20.15
Observed:	23.52	24.69	27.25	21.69	22.86	25.18
Predicted:	18.72	20.83	25.70	17.52	18.30	23.83
Mean Difference:	4.80*	3.86*	1.55*	4.17*	4.56*	1.35*
Texas						
Pretest:	16.22	14.86	15.47	14.91	13.50	13.94
Observed:	23.52	22.45	22.66	21.58	20.48	21.20
Predicted:	20.04	19.23	19.71	18.62	17.47	17.85
Mean Difference:	3.48*	3.22*	2.95*	2.96*	3.01*	3.35*
Utah						
Pretest:	21.82	23.71	26.36	19.30	21.66	22.88
Observed:	27.36	30.92	33.82	25.09	28.61	29.81
Predicted:	25.84	28.03	29.48	23.00	26.16	25.65
Mean Difference:	1.52*	2.89*	4.34*	2.09*	2.45*	4.16*

*Statistically significant mean difference between observed and predicted means $p \leq .05$.

The analysis and reporting of observed versus predicted posttest scores was done to show how SKI*HI children perform at posttest compared to what would be expected due to maturation alone, not primarily to show whether the differences between observed and predicted mean posttest scores were due to chance. The reporting of observed versus predicted scores from 1986 through 1989 was done to show how SKI*HI children consistently, over time perform better at posttest than would be expected due to maturation alone. Please consider these data in conjunction with the other analyses (e.g., Table 3 and Appendix B). The comparison of observed with predicted posttest means provides just one indication of program effectiveness.

With respect to whether the differences are significant, this can be looked at from two perspectives. First, are the differences large enough to be important? If, on the average, hearing-impaired children, who are primarily severely to profoundly impaired, are gaining 2.5 to 3 months in receptive and expressive language more than predicted based on maturation alone, these are important differences. As noted on page 15 of the recertification statement, McConnell (1974) reported less than one month of gain for every month of instruction.

Second, are the differences statistically significant? As seen in Revised Table 2, all mean differences were statistically significant, except 1988-89 for Arkansas and Oklahoma on the Receptive LDS and 1988-89 for Oklahoma on the Expressive LDS. We had not previously reported statistical significance of the difference between observed and predicted posttest means, because there is really no appropriate model for applying tests of statistical significance to these data. We could have treated the predicted means as population values and then asked the question whether the observed posttest means were significantly different from the population values. We decided not to do so previously for two reasons: (a) The treatment of the predicted posttest means as population values would be artificial, because there are no actual population values; and (b) The predicted and posttest means are not values randomly sampled from a population, leaving no logical basis for testing a null hypothesis.

6. Is the posttest score that you used the actual score minus the predicted one? That is, did you correct for maturation? In Table 3, we used the observed, mean posttest score as compared to the observed, mean pretest score. As indicated above, in response to question 5, tests of statistical significance were not used previously to compare observed versus predicted mean posttest scores. However, Revised Table 2 above provides the results of tests of statistical significance, thus correcting for maturation.

7. Do you have any data on long-term impact of your early intervention program on children served over a 3 to 5 year period? In order to investigate the specific long-term effects of the SKI*HI Model, a research project was conducted by Watkins (1987), using children from a study by Clark (1979). These children had been in the Utah Parent Infant Program from 1974 through 1976 and were 6 to 13 years of age at

the time of the study. These children were matched with children from Alabama, Tennessee, and Idaho who had not received home intervention programming on variables such as hearing loss, age, and the existence of other handicaps. Factors that could confound the treatment effect were selected and included age, hearing loss, existence and severity of other handicaps, Index of Social Position, age of mother, and number of childhood middle ear infections. These factors were controlled for in the study using analysis of covariance techniques.

The home intervention children scored statistically significantly higher than the children without home intervention on the following outcome variables: child receptive and expressive language, communication, academic achievement, speech, social-emotional adjustment, parent attitudes, parent communication, and hearing-aid management.

It was also determined that the group differences were educationally significant as well. Standardized mean differences (effect sizes) were computed. All educationally significant effect sizes favored the home intervention children over the children without home intervention.

8. Clarify the rules for submitting data to the National Data Bank, such that 1,934 children were included in the sample, but 4,000 children and their families are in the program annually. Participation in the National Data Bank by adoption-site personnel is completely voluntary and done without monetary compensation. All data submitted to the National Data Bank are included in the analyses.

Please remember that there is no compensation for participation, that the parent advisors must be trained to collect data, and that the parent advisors must collect data over and above their responsibilities to the family and the child and must do so over a period of two to three years for each child. In a national study in which a long questionnaire was used, Wise (1977) reported a response rate of about 25%, even though a very extensive effort was made to reach the subjects. For the National Data Bank, parent advisors are not simply responding to a one-time questionnaire; they must make a commitment to collect data for the duration of each child's program in their caseloads. During the 1989-90 year (i.e., our most recent data-collection year), approximately 250 agencies used the SKI*HI model, serving approximately 5000 children. Personnel from 28% (n=69) of the sites participated in the National Data Bank for that year, representing approximately 25% of the children being served. We consider the participation level in the National Data Bank to be excellent.

9. Briefly define receptive and expressive language scores (regarding Claim #1). Receptive and expressive language scores are obtained from the Language Development Scale (LDS). The scores are recorded as language ages in months. The age intervals were obtained by examining 19 different language development scales for normal-hearing children that were available in the literature at the time of the test's development. (See Page 7, Instruments and Procedures Section, for a more complete description of the LDS.)

10. <u>The discussion of whether PAs' scores are reliable and valid on p. 14 does not adequately address the issue. Please elaborate and strengthen this discussion</u>. As stated in the recertification document on page 14, inter-examiner agreement data for the Language Development Scale are only available for scores from children used in the test-validation study (Tonelson & Watkins, 1979). However, perhaps it would be helpful to elaborate on that study which was briefly described on page 7 of the recertification document.

The SKI*HI Language Development Scale (LDS) lists the expressive and receptive language skills that a child of a particular age would normally demonstrate. Unlike other scales, the LDS does not emphasize auditory items. In addition, children who use total communication are not penalized on this scale as they are on many other language development scales. The child is given credit for understanding and use of signs. Credit is also given for misarticulated verbal responses. Therefore, hearing-impaired children are not penalized for their disability.

The data gathered for the reliability and validity study were obtained from children in SKI*HI programs across the country. Three different procedures were used to estimate the reliability of the LDS: (a) The percentage of agreement among 23 examiners was calculated by having the examiners observe, via videotape, children manifesting language behaviors. Inter-examiner agreement was 80% and 78% for the receptive and expressive scales, respectively. (b) Intra-examiner agreement (or test-retest reliability) was estimated by correlating examiners' responses from observation one and observation two. Intra-examiner agreement was .86 and .92 for the receptive and expressive scales, respectively. (c) Finally, internal consistency coefficients, calculated from the completed scales of 115 hearing-impaired children were .93 and .94 for the receptive and expressive scales, respectively.

Two different procedures were used to estimate the validity of the LDS. (a) The concurrent validity of the LDS was estimated by correlating scores on the LDS with scores on the REEL. Coefficients of .78 and .79 were obtained for the receptive and expressive scales, respectively. (b) With respect to construct validity, the coefficients of reproducibility as determined by the Guttman scaling technique were uniformly high for both units and individual items within units. A .99 coefficient of reproducibility was obtained for both the receptive and expressive scales.

The SKI*HI Institute does not conduct formal studies on the reliability and validity of the entries on the Data Sheets. However, we do have confidence in our training program to prepare parent advisors to complete the Data Sheets accurately. The careful training includes a description of and orientation to the data-collection system and the Data Sheets; practica, spaced throughout training, on making entries on the Data Sheets; and feedback from trainers on the practicum experiences. Detailed printed instructions are provided to each new

parent advisor and to each program supervisor. Parent advisors and their supervisors are encouraged to contact the SKI*HI Institute whenever a question arises as to data collection and reporting.

11. Discuss the extent to which the results in Table 4 are statistically and/or educationally significant. The data in Table 4 refer to numbered programmatic levels in the SKI*HI curriculum manual. These specific levels of auditory, communication-language, and vocabulary development are provided on the back of Appendix A. The skill-acquisition sequences were based on the developmental literature. All skills are considered important to the development of communication and language and to future educational achievement.

Dependent t-tests were used to determine if the differences between the pre-and posttest auditory levels, communication-language levels, and vocabulary levels were statistically significant. All differences were statistically significant ($p < .001$). The standardized mean differences for all three variables were large (SMDs = 1.0, 1.1, 1.0, respectively) by Cohen's (1988) standards. These indicate that, at the ending of the treatment periods, the average child's developmental level was higher than 84% of the children's developmental levels at the beginning of the treatment period. Assuming that moving through the developmental levels is important to future achievement, these are important gains in a relatively short time period (i.e., median time ranged from three to five months--see Table 4). As stated on page 15 of the recertification document, no studies were located to provide a comparison for the data reported here. The data provided in the prior paragraph should be interpreted with caution. We had originally not reported tests of statistical significance and effect sizes because the data presented in Table 4 are based on ordinal data, not interval-scale data.

12. Explain the statistical and/or practical significance of data in Tables 5 - 7. If possible, compare these results with what might be observed with children and their families who are not receiving such special assistance. As stated on page 15 of the recertification document, we did not locate any studies which provided a comparison for the data reported here. Also, tests of statistical significance could not be conducted without a comparison group.

With respect to Table 5, which was supplementary evidence for Claim 2, we reported that 60% of the children were wearing their hearing aids full-time within a median time period of one month. Because it is often difficult to get small children to wear their hearings aids, this is important supplementary data for those who believe that it is important for children to wear their aids full-time to enhance communication and language development.

Table 6, column 1, provides data regarding the mean visit number at which the parent achieves competency at managing the hearing aid. Because full-time hearing-aid use is considered important for communication and language development, and because the services are provided in homes that are often in rural areas, it is important for

parents to be able to manage the hearing aid. Parents do not go to a center for services and must be able to perform such skills as a daily listening check, trouble shooting for feedback, and caring for the hearing aid. Further, they must understand the importance of appropriate, consistent amplification. On the average, SKI*HI parents are able to pass the competency test by the 12th visit to the home (i.e., within three months). This indicates that parents assimilate a large amount of information and a large number of skills in a short period of time.

Table 6, columns 2 through 6, provides data regarding the number of parent skills acquired each month. If we assume that parent-skill acquisition in promoting auditory, communication, language, and cognitive growth is important for ameliorating the negative impact of hearing impairment on the child, then these data are important. Family-focused home programming is the basis of the SKI*HI model. It is clear from the table, that parents are learning anywhere from one to three new skills per month in <u>each</u> of the curricular areas. For example, a particular parent is likely learning 1 to 2 new auditory skills, <u>plus</u> 2 to 3 new communication skills, <u>plus</u> 2 to 3 new cognitive skills all in one month (typically, in 3 to 4 home visits). Armed with these new skills, this parent would be able to stimulate auditory, communication, and cognitive growth in her child throughout the day and week, in the absence of the parent advisor.

Table 7 provides data regarding age of identification and time interval between identification age and program-placement age. SKI*HI is based on the theoretical framework which assumes that early identification and early home programming are critically important for communication, language, educational, and social/emotional development in the child. These variables seemed so crucial that we determined that it was important to provide evidence that they actually did occur. As indicated on page 15, according to the Commission on Education of the Deaf to the President and the Congress of the United States (1988), the average age of identification is reported as 30 months. For SKI*HI children, the average age was 18.6, with a median of 17 months. For 50% of the SKI*HI children, home programming began within 3 months of identification. We did not find any studies to provide a comparison for the time interval between identification age and program-placement age.

13. <u>Explain the programmatic significance of Claim #4 (age at which children are identified). In particular, why it should be an outcome and not simply a means to obtain the outcome (such as greater language development)</u>. Yes, we did treat age of identification as an outcome variable itself. However, we also consider it a means to obtain the outcome of greater language development gains. Perhaps we should have treated it as an intermediate outcome, because early identification is considered so critical to later gains. However, as stated in response to Question 12 and on page 3 of the recertification document, because early identification is a focus of the SKI*HI model, we determined that it was a crucial variable and that it was important to establish that it actually did occur.

14. How representative is SKI*HI of all hearing-impaired children? A recent report was obtained from Gallaudet University which provided us with 1989-90 annual-survey results of 46,666 hearing-impaired children and youth. The Gallaudet demographic data and SKI*HI 1986-89 demographic data are provided in the table that follows. Clearly, SKI*HI children are representative of hearing-impaired children nationally.

Demographic Comparisons of 1986-89 SKI*HI Children with Gallaudet University's 1989-90 Annual Survey of Hearing-Impaired Children and Youth

	1989-90	1986-89 SKI*HI Data					
	Gallaudet	SKI*HI Overall	Ark	Okla	Tenn	Texas	Utah
Gender	%	%	%	%	%	%	%
Male	53.9	51.6	53.9	48.9	47.6	47.7	57.3
Female	45.8	44.2	41.1	48.9	39.5	47.9	40.0
Unreported	0.3	4.2	5.0	2.2	12.9	4.4	2.7
Ethnic Background							
Caucasian	63.4	72.3	79.9	81.8	71.5	56.1	90.5
Black	17.0	16.0	20.1	7.8	27.2	15.9	2.8
Hispanic	13.6	8.6	0.0	2.6	0.0	24.1	3.4
American Indian	0.7	1.4	0.0	7.8	0.0	0.0	1.7
Oriental	3.3	0.7	0.0	0.0	0.7	1.7	1.1
Other	2.0	1.0	0.0	0.0	0.6	2.2	0.5
Cause of Hearing Loss							
Maternal Rubella & CMV	8.3	6.8	7.1	8.0	5.9	8.5	4.3
Birth Trauma	4.6	3.9	5.4	0.0	4.4	4.0	4.3
Pregnancy Complication	6.0	3.1	7.1	0.0	4.5	3.6	1.4
Heredity	24.9	19.6	37.5	14.0	25.4	18.5	18.6
Premature	8.8	6.5	1.8	4.0	11.9	6.5	11.4
Defects at Birth	7.9	7.8	7.1	14.0	6.0	2.8	10.0
Meningitis	16.9	29.5	14.3	32.0	20.9	31.0	24.3
High Fever or Infection	9.2	5.7	1.8	14.0	4.5	5.2	5.7
Otitis Media	6.8	7.1	10.7	10.0	6.0	8.1	7.1
Other	6.6	10.2	7.2	4.0	10.5	11.8	12.9
Hearing Loss							
Normal	7.9	2.0	1.6	3.1	2.1	1.8	3.6
Mild	9.1	8.2	3.9	10.4	7.1	6.9	17.1
Moderate	11.9	20.7	15.5	26.0	19.3	20.8	27.0
Severe	31.2	43.4	47.3	40.6	42.1	44.3	29.7
Profound	39.9	25.7	31.7	19.9	29.4	26.2	22.6
Communication Method							
Aural/Oral	38.6	36.2	36.0	43.5	39.7	28.7	64.2
Sign, etc.	61.4	63.8	64.0	56.5	60.3	71.3	35.8

15. What is the basis for eligibility in the program? Although the eligibility requirements may vary slightly from program-to-program, the basis for eligibility into the program consistently is the presence of a hearing loss. Regardless of any other handicapping conditions, any child, birth through age five, with a diagnosed hearing loss is eligible for the program. Any child referred to the program or identified by the program as having a hearing loss is accepted. Please note that we have fewer normal and fewer mild children than the national average and that approximately 90% of SKI*HI children have hearing losses ranging from moderate to profound, as compared to 83% for the national average (see table on prior page).

16. Why use only examiners who know the pretest scores? The SKI*HI model is an educational model for delivery of services to the families of children with hearing impairments in their homes. Many of these homes are in rural areas. Nearly all services are provided in the home, including the testing of the children and the advisement of parents. As a working, replicable, educational model for delivery of services in the home, the parent advisor does both the testing and providing of services to the family and child. There simply are no financial resources for hiring someone other than the parent advisor to travel to the home to do the testing.

17. What normed group was used for developing the predicted LDS scores? Perhaps the reviewer misinterpreted the sentence on page 7 --that is, "the predicted posttest score was used as a standard against which to compare the observed posttest score." The children served as their own norming group. "Standard" does not refer to a standard or normed group, but is a prediction of what the child should score if he continues to develop at his pretest rate without intervention. What the child actually scores at posttest with intervention is then compared to this "standard."

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MAR 01 REC'D

PROGRAM
EFFECTIVENESS
PANEL

February 27, 1991

Thomas C. Clark, Ph.D.
SKI-HI Institute
Utah State University
Department of Communicative Disorders
Logan, Utah 84322-1900

Dear Dr. Clark:

Congratulations on the approval of your program, SKI*HI, by the Program Effectiveness Panel (PEP). Your PEP approval became effective on February 19, 1991. The PEP project number for SKI*HI is 78-192R2. Approval by the PEP means that you have provided convincing evidence of the effectiveness of your program and are eligible to apply for dissemination funds from the National Diffusion Network (NDN). The attached summary of panel comments is provided for your information.

For additional information about the National Diffusion Network, you may call Linda Jones at (202)219-2153. Again, congratulations.

Sincerely,

Tom Schultz FNR

Tom Schultz, Chair
Program Effectiveness Panel

TS/alw

Enclosure

cc: Linda Jones, Project Officer, Program Effectiveness Panel
Charles Stalford, Staff, Program Effectiveness Panel

Summary of Program Effectiveness Panel Comments
Project SKI*HI
January 11, 1991

The evaluation design presented is appropriate for the objectives stated. The strategies used to provide evidence of achievement seem relevant, based on current literature, and demonstrate efficacy of program. Although not ideal, the comparison of the children with themselves is a good example of a quasi-experimental design when a control group is not possible.

The results are impressive, both statistically and educationally, and the longitudinal data are convincing, although not specifically related to a claim. Overall, the program seems useful and does help hearing impaired children and their parents. But a determination of reliability and validity of the data, at least on a sample basis, would have strengthened confidence in the claims in the program.

The case has clearly been established for the replication of this program. Although one panelist wondered whether Claim 4 regarding early identification of hearing impaired children was warranted as being a claim in its own right. In particular, whether a proven mechanism exists to identify hearing impaired children. In this vein, another panelist suggested that it would be helpful, nevertheless, to include a description of how an adopter should go about establishing linkages and procedures with individuals and social service agencies.